FRAMEWORK FOR EVALUATING PROGRAMMING LANGUAGES FOR COMPUTER GRAPHICS

By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for Degree of Master of Science

November 2003

بسم الله الرحمن الرحيم

قل إن صلاتي ونسكي ومحياي ومماتي

لله رب العالمين

Abstract of the thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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With the continuous increase of the available programming languages over the last few decades, it becomes essential to properly select the language to be used for any field of computation so as to get the best outcome of the language for that specific field. As the fields of Computer Graphics and Computational Geometry are important ones, it becomes essential therefore to make a comparative study of the programming languages which suit those fields best.

In this study, a new framework has been developed for comparing different programming languages by studying selected factors which are: Speed, Memory usage, EXE file size and Source code size. The study concentrated on four programming languages in order to test the framework, although the developed framework is capable to support any programming language.

This study compares those features and the capabilities of the four widely used programming languages as samples. This comparison is for examining the programming languages in order to find the specific attributes and capabilities of each language, and to identify the best language for each of the selected factors when used for Computer Graphics and Computational Geometry.

The framework concludes that Visual C++ is the fastest language in handling Computational Geometry problems; C++ was the most efficient language in memory usage. Visual Basic has the smallest EXE file size and smallest source code size.

Small and simple programs consume less computer resources than bigger and more complicated programs. In order to test this logical hypothesis, the framework has been tested upon three types of programs varying in their levels of difficulties and complications, i.e. graphics primitives, curves and splines, and complicated geometric objects. The research proved that there is a difference between the three levels of programs in terms of computer resources consumption, hence proving that the hypothesis is correct. However the details of the comparison performed by the framework developed, when applied to the graphical programs of different level of complication has shown that different programming languages' reaction in terms of consumption of resources varies from one language to another.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

RANGKA KERJA BAGI MENILAI BAHASA-BAHASA PENGATURCARAAN UNTUK GRAFIK KOMPUTER

Oleh

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Bilangan bahasa pengaturcaraan di pasaran mengalami peningkatan yang berterusan sejak beberapa dekad, lantas amat penting untuk memilih bahasa pengaturcaraan yang sesuai bagi memperoleh hasil terbaik dalam tugasan yang spesifik dalam bidang pengkomputeran. Begitu juga bidang Grafik Komputer dan Geometri Komputan yang berkepentingan tinggi, kajian komparatif berkenaan bahasa-bahasa pengaturcaraan perlu dilakukan untuk menentukan bahasa yang paling sesuai digunakan untuk bidang tersebut.

Dalam kajian ini, satu rangka kerja telah dibangunkan untuk membuat perbandingan terhadap beberapa bahasa pengaturcaraan dengan mengkaji beberapa faktor pilihan iaitu: kepantasan, penggunaan ruang ingatan, saiz fail EXE dan juga saiz fail kod sumber. Walaupun kajian ini hanya menjurus kepada empat bahasa pengaturcaraan bagi menguji keupayaan rangka kerja yang dibangunkan, ia mampu menerima sebarang bahasa pengaturcaraan.

Kajian ini membandingkan ciri-ciri dan keupayaan empat bahasa pengaturcaraan yang digunakan secara meluas sebagai bahan sampel. Perbandingan ini bertujuan untuk mendapatkan atribut spesifik dan keupayaan setiap satunya bagi mengenal pasti bahasa yang terbaik berdasarkan faktor-faktor tertentu dalam kesesuaian penggunaan bahasa tersebut untuk Grafik Komputer dan Geometri Komputan.

Rangka kerja kajian memberikan kesimpulan bahawa Visual C++ adalah yang terpantas mengendalikan tugas dalam Geometri Komputan, manakala *C++* pula merupakan yang paling efisyen dalam penggunaan ruang ingatan. *Visual Basic* pula mempunyai saiz fail EXE dan kod sumber yang paling kecil.

Atur cara komputer yang mudah dan ringkas kurang menggunakan sumber komputer, berbanding atur cara yang besar dan kompleks. Untuk menguji hipotesis logikal ini, rangka kerja ini telah diuji berdasarkan tiga jenis atur cara yang berbeza tahap kerumitannya; misalnya primitif grafik, garis lengkung dan *spline*, dan objek geometri yang kompleks. Kajian yang dijalankan telah menunjukkan terdapat perbezaan dalam penggunaan sumber komputer antara ketiga-tiga tahap atur cara, lantas membuktikan hipotesis ini benar. Walau bagaimanapun, perincian berkenaan dengan perbandingan yang dilaksanakan berdasarkan rangka kerja ini, apabila diaplikasikan kepada atur cara grafik yang berlainan tahap kerumitannya telah menunjukkan reaksi penggunaan sumber komputer yang berbeza antara satu bahasa pengaturcaraan dengan yang lain.

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I certify that an Examination Committee met on date of viva to conduct the final examination of Akram Mohammed Zeki on his Master of Science thesis entitled "Evaluation of Different Programming Languages used in Graphics and Computational Geometry" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

AKRAM MOHAMMED ZEKI

Date:

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